Ocean Research Report

Expedtion #9A

r/v REGINA MARIS

Panama City, Panama - Galapagos, Ecuador

1 - 27 August 1978

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THE GALAPAGOS ARCHIPELAGO: SEABIRDS IN RELATION TO THE CROMWELL CURRENT AND OBSERVATIONS ON TERRESTRIAL FAUNA

Cruise Report of
r/v REGINA MARIS EXPEDITION #9 A
Panama City, Panama - Galapagos, Ecuador
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"Seabird Composition in Relation to the Cromwell
Current"

to the

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SUMMARY

r/v REGINA MARIS left Panama City on 1 August for the Galapagos Islands and returned to Puntarenas, Costa Rica on 1 October (Fig. 1). During Part I of the cruise (1-27 August), marine mammal sightings were collected en route to the Galapagos Islands and on an opportunistic basis while in the archipelago, since seabird research was the primary focus when amongst the islands (see r/v REGINA MARIS Expedition #9A: Seabird Studies in Relation to the Cromwell Current). During Part II of the cruise (29 August - 1 October), r/v REGINA MARIS was chartered by the National Marine Fisheries Service to test the feasibility of using a sailing vessel (a quiet platform) to study the behaviour of spinner porpoises (*Stenella longirostris*) and spotted porpoises (*S. attenuata*) - the 2 species involved in the tuna-porpoise fishery - and to determine their abundance and distribution within the study area. Cetacean sightings for both parts of the cruise are summarized in Tables 1a and 1b. We began to see spinner and spotted porpoises on Part II of the cruise, north of the Galapagos Islands, and diversity of species also increased in these waters.

INTRODUCTION

Yellowfin tuna (*Thunnus albacores*) are frequently seen swimming with schools of spotted porpoise (*S. attenuata*) and spinner porpoise (*S. longirostris*), an association which is thought to be related to known (Harris, 1969). The Cromwell Current, which is a deep current that flows eastward and upwells in the Galapagos Islands, is generally responsible for the cool waters around the islands. This current system, though not well-known, has been studied by Pak and Zanevald (1972) and by Maxwell (1974). The currents which bathe the archipelago are, theoretically, of 2 types: warm water having a seasonal origin in the South Equatorial Current and cold, nutrient-rich water originating from an upwelling of the Cromwell Current. Our hypothesis was that the greatest density of seabirds should be found in the areas most affected by the Cromwell Current, that is, in the western archipelago.

Methods

Birds were sighted in a 90^{o} arc within 350 metres from the bow of the boat. The ship's speed was approximately 5 knots under combinations of sail and motor. The number, species, group composition, and bearings of seabirds passing through the quadrant were recorded. Feeding frenzies of seabirds seen through 20-power binoculars were noted.

Surface temperature (^{o}C and ^{o}F) and salinity were recorded every 30 minutes, while the boat was underway, using a YSI salinity-conductivity-temperature meter (Model 33). Temperature traces through the water column were made at 22 stations using an expendable bathythermograph provided by the National Marine Fisheries Service. Environmental data collected included air temperature, cloud cover, sea state, visibility, and wind speed and direction.

Results

During 145.7 hours of observation, 8399 seabirds were seen. Surface water temperature and seabird densities are shown along the transect lines in Figs. 1 and 2, respectively. Temperature profiles suggested that upwelling was most intense around the northern parts of Islas Isabela and Fernandina. As we moved farther from the islands, surface water temperature increased consistently, indicating less intense upwelling. Seabird concentrations were greatest in coldest waters, although island proximity and time of day influenced this pattern. In warm tropical water ($\overline{X} = 23^{\circ}C$), we observed only 19 birds/hour, whereas in colder water ($\overline{X} = 20^{\circ}C$), seabird density was 84 birds/hour. The range of seabird densities within our fixed viewing field varied between over 170 birds/hour within 1-5 miles of land and less than 12 birds/hour when 50 miles from land.

The composition of the seabirds at different distances from the islands changed. Interestingly, the importance of closely related species differed rather dramatically with distance from land. Audubon's shearwaters (_Puffinus lherminieri_) were 60% of the birds within 1 mile of land and less than 5% of the birds from 5 to 10 miles from land. Hawaiian petrels (_Pterodroma phaeopygia_) were less than 10% of the birds within 15 miles of land, but rose to 20% of the birds from 15 to 20 miles from land. White-vented storm petrels (_Oceanites gracilis_ made up 50% of the storm petrels within 1 to 5 miles of land and were less than 5% of the storm petrels farther from shore.

Conclusions

Our results suggest that marine productivity is an important determinant of density and seabird community composition. This productivity, in turn, is greatest in areas of cold water and upwelling. Furthermore, closely related species of seabirds are spatially segregated.

TERRESTRIAL STUDIES

Between 10 August and 27 August, we landed on Islas San Cristobal, Santa Cruz, Genovesa, Fernandina, Isabela, Espanola and Baltra (Fig. 1).

Ticks

Continuing research begun in 1970-1972, the chief scientist collected ticks from marine iguanas (Amblyrhynchus cristatus) on Islas Genovesa and San Cristobal. The iguanas were measured, weighed, sexed and the ticks were counted. Ticks were immersed in seawater on the ship to determine viability.

Penguins

At Punta Espinosa on Isla Fernandina, nest burrows of the Galapagos penguin (Spheniscus mendiculus) were checked to see if previous residents still retained them, and to determine the stage of the breeding cycle. Only 2 active nests were found, both had 2 chicks and 1 adult. The adults and 2 of the juveniles were banded and weighed. Since both burrows had 2 young and 1 burrow had young that would fledge in less than a week, it appears that breeding was just ending. Some juveniles that recently fledged were also seen. Cabo Douglas, Isla Fernandina, was much more active. More penguins were seen. Birds were copulating and braying, but no active nests were found. A number of molting birds were congregated on the shoreline. Burrows on the islands in Elizabeth Bay, Isla Isabela, were similarly checked. Of the 60 nest sites, only 3 contained chicks. One young just ready to fledge was banded. Again, from the condition of the nesting sites, it appeared that the breeding season had just finished. The islands had only 10 penguins standing on the shore, all of them molting.

Volcano Observations

While anchored at Punta Espinosa, it was noted that Isla Fernandina was actively erupting. This observation led to an ascent of the volcano's summit on 18 August. Sixteen people made it to the top of the crater and watched Fernandina erupt. A watch was maintained throughout the night to monitor changes in volcanic activity. Photographs were taken on the hour and the intensity of the eruption was rated every 10 minutes. Movie footage during the night and morning was also taken. Sketch maps, film and notes are being sent to Tom Simkins at the Smithsonian Institution in Washington, D.C. for use in the world volcano watch.

Conclusions

The scientists, after leaving r/v REGINA MARIS, will continue to study marine iguanas and their ticks on Isla Santa Cruz. Information on penguin banding was given to the Darwin Research Station. Copies of this cruise report have been deposited at the station as well as with the Galapagos National Park.

ACKNOWLEDGEMENTS

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BIBLIOGRAPHY

Harris, M.P. 1969. J. Zool. Proc.Zool. Soc. London 159: 145.

Maxwell,D.C. 1974. Thesis, Ohio State University.

Pak, H. and J.R.V. Zanevald. 1973. J. Geophys. Res. 78: 7845.

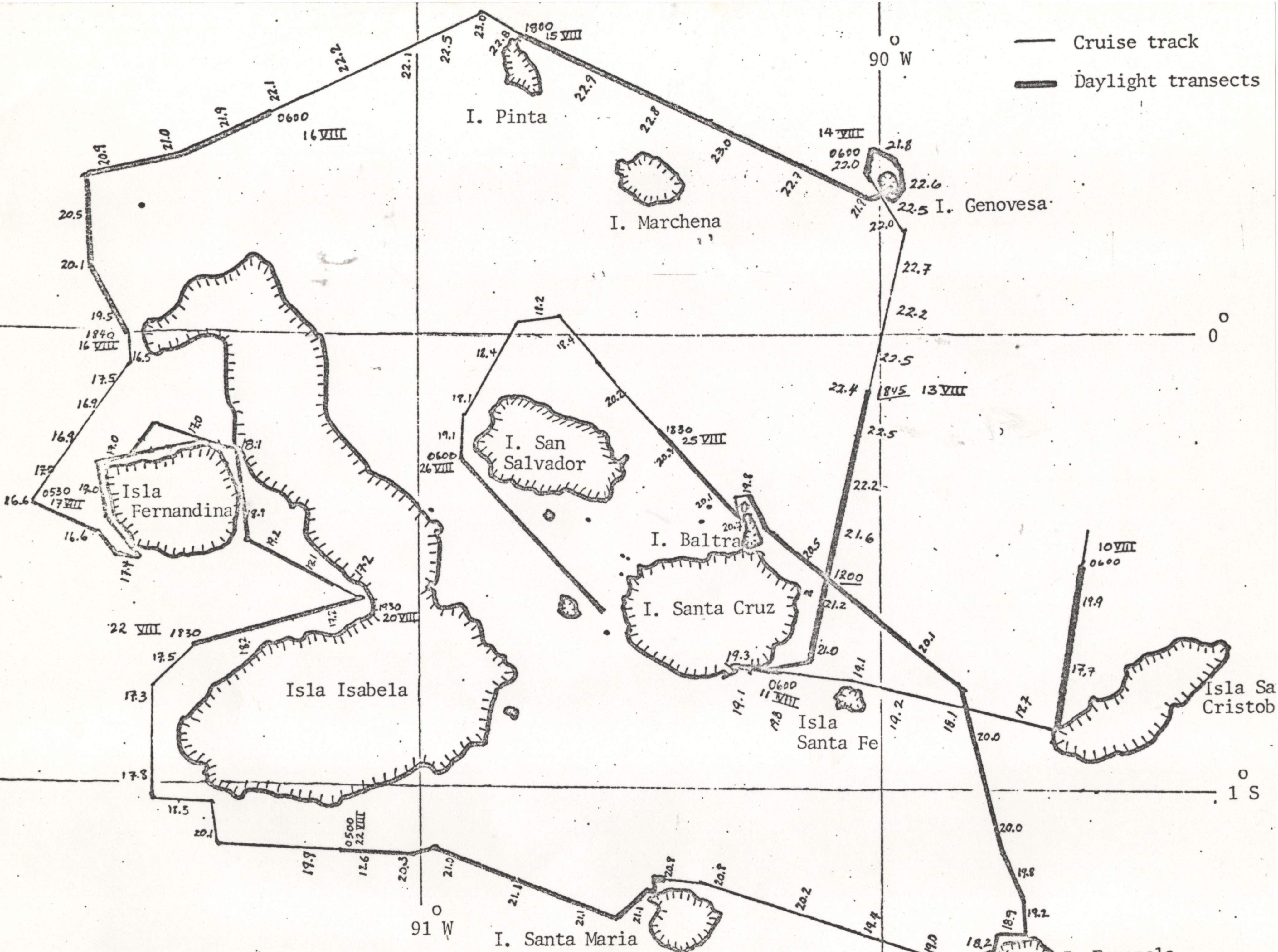

Fig. 1. Cruise track of REGINA MARIS & surface water temperatures (°C).

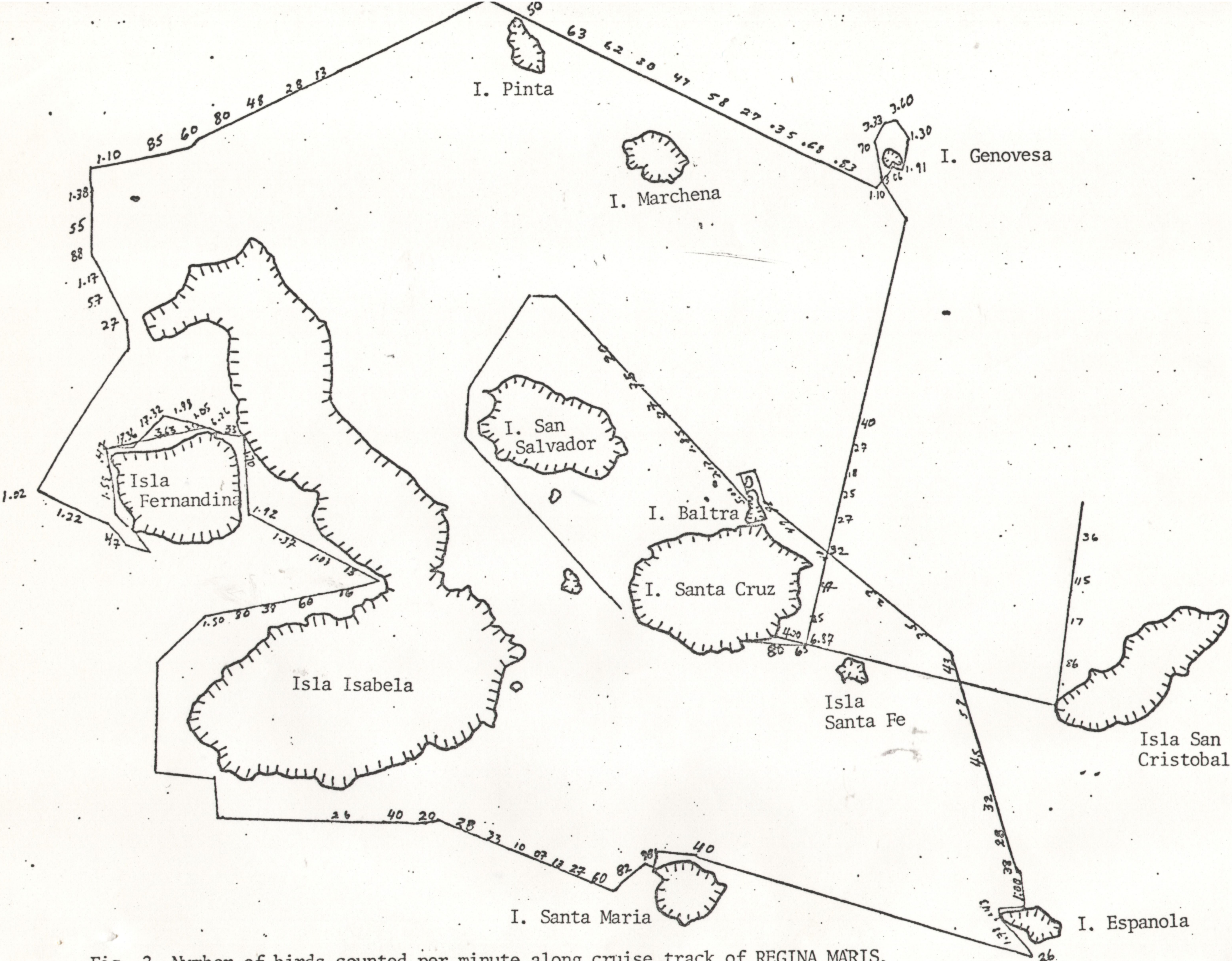

Fig. 2. Number of birds counted per minute along cruise track of REGINA MARIS.